On polar/non-polar atmospheric linkages: observations and model diversity

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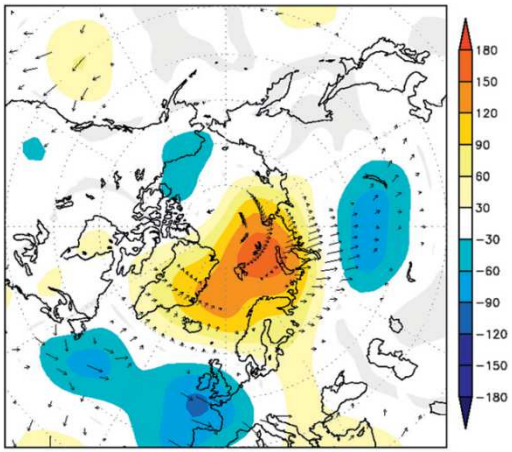
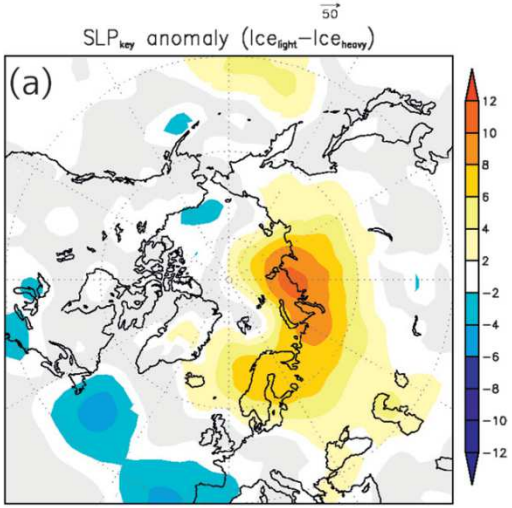
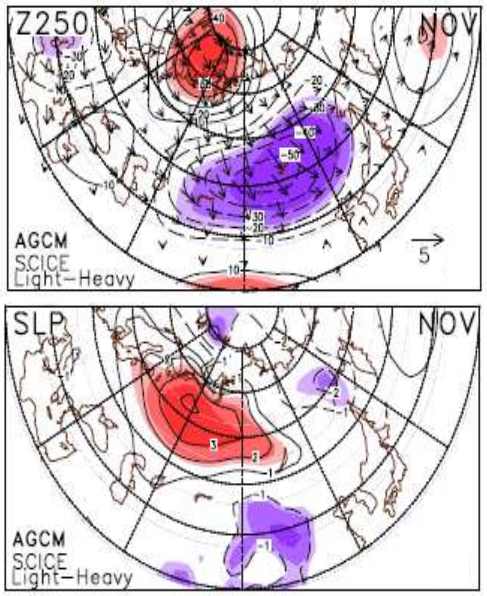
[MOD] A. Arribas (MetOffice), Y. Gao (NERSC/BCCR), V. Guemas (BSC, CNRM), M. P. King (URC/BCCR), D. Matei (MPI-M), R. Msadek (GFDL, CERFACS), W. Park (GEOMAR), E. Sanchez-Gomez (CERFACS)

Z250 / WAF (DJF)





Inoue et al. (2012, GRL)

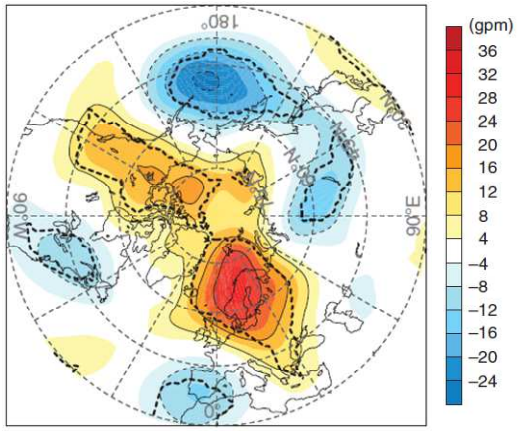


Honda et al. (2009, GRL)

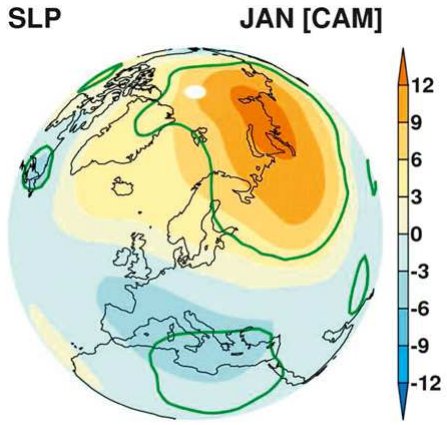
might be non-linear to SIC reduction!

Petoukhov and Semenov (2010, JGR)

ΔZ500 for ND, CAM5

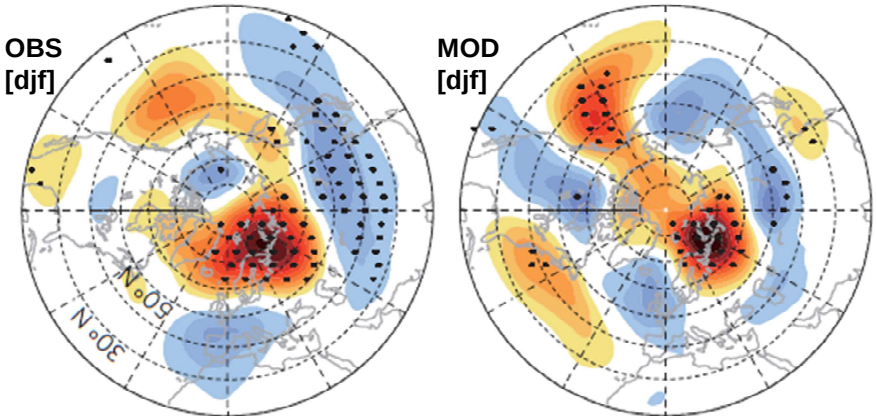


Kim et al. (2014, Nat.Comms)

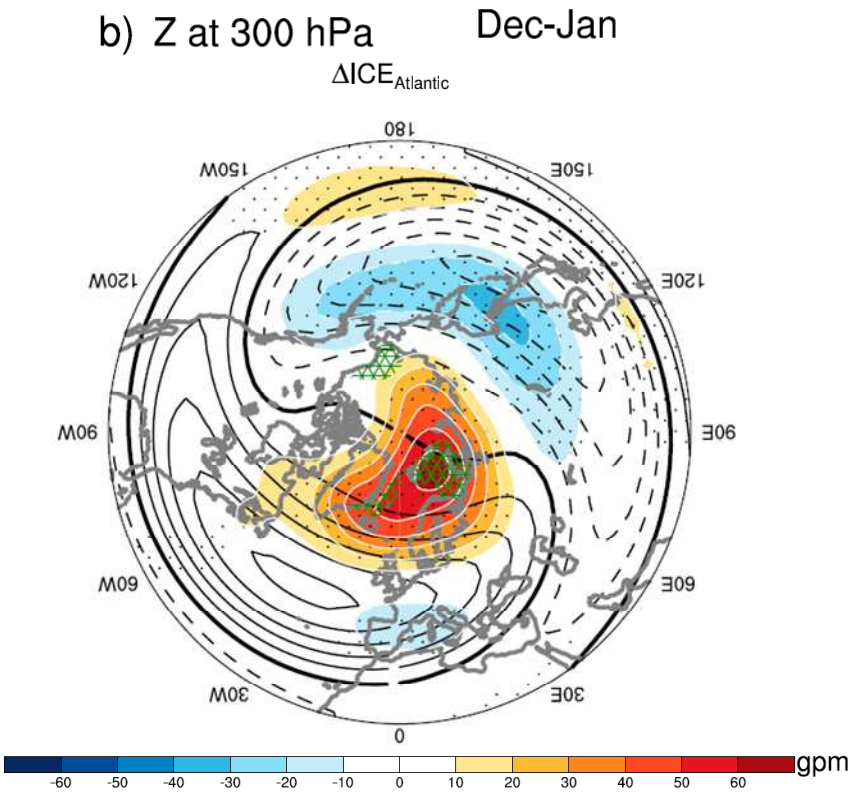


Grassi et al. (2013, JCLIM)

RECENT REVIEWS: Bader et al. 2011; Cohen et al. 2014; Vihma 2014; Walsh 2014; Gao et al. 2015; Overland et al. 2015



Mori et al. (2014, Nat.Geosci)

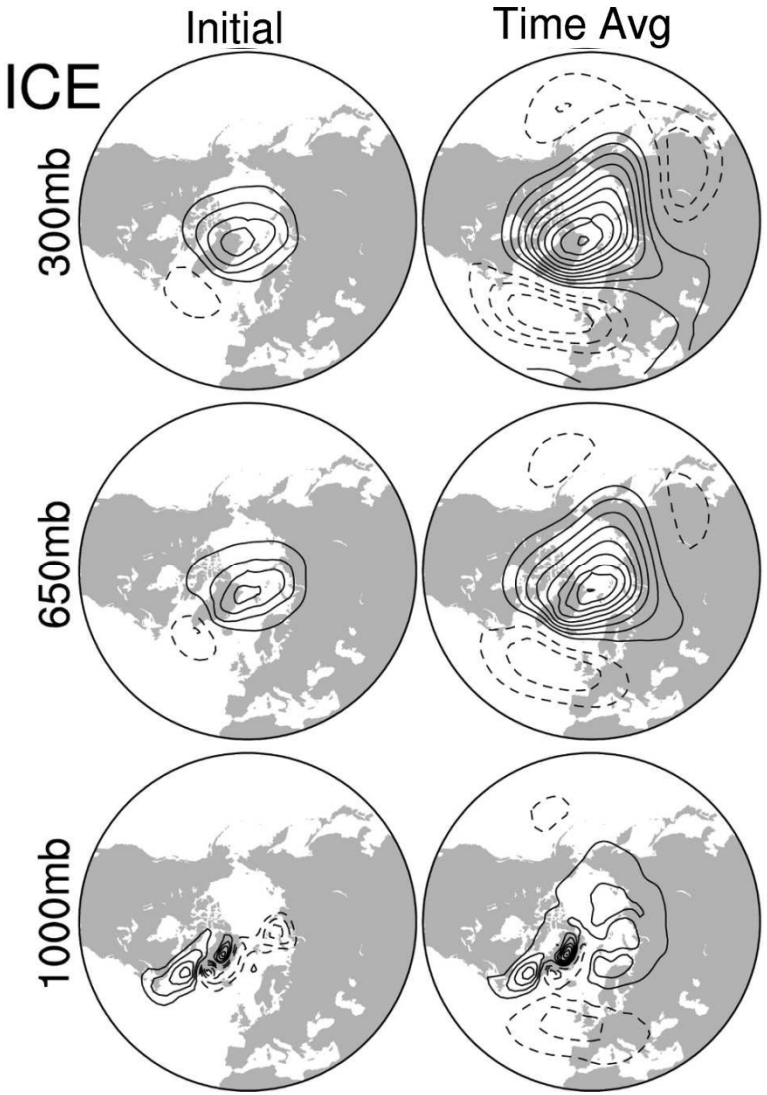


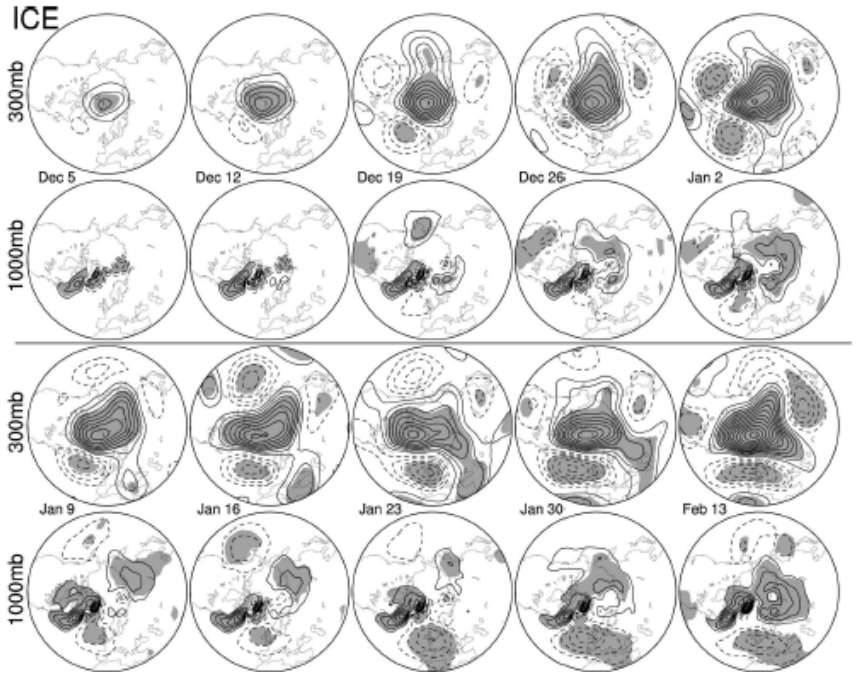
Sun et al. (2015, JCLIM)

might be non-linear to SIC reduction!

Petoukhov and Semenov (2010, JGR)

RECENT REVIEWS: Bader et al. 2011; Cohen et al. 2014; Vihma 2014; Walsh 2014; Gao et al. 2015; Overland et al. 2015

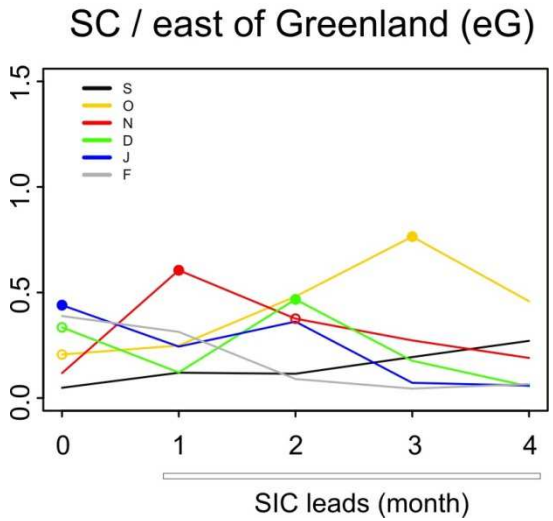




the equilibrium response to SIC reduction over G-B Seas, which projects on the negative NAO, is reached in about two months

Deser et al. (2007, JCLIM)

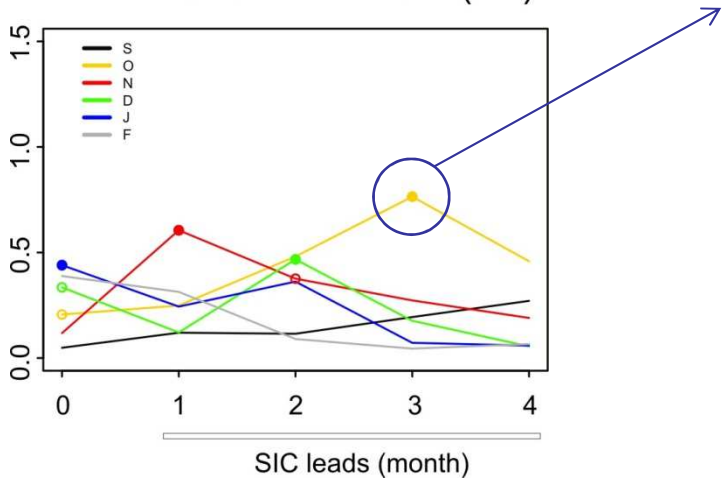
HadISST



- detrended, monthly anomalies;
period 1979-2013;
target – cold season (Sep-to-Feb)

HadISST

SC / east of Greenland (eG)



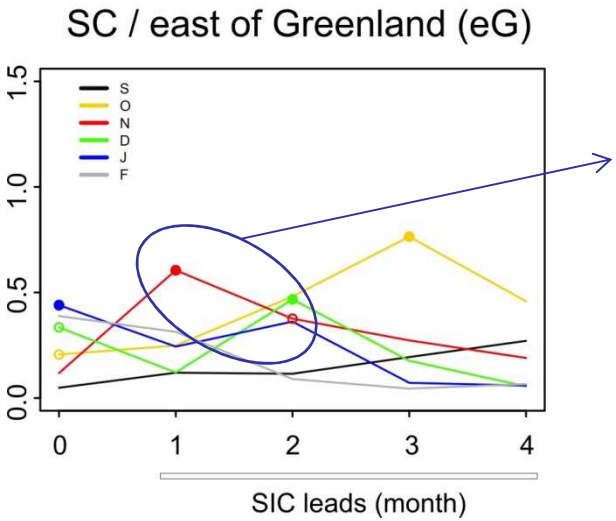
might be linked to winter blocking over Eurasia

Mori et al. 2014 (Nat.Geosci); García-Serrano et al. (2015, JCLIM)

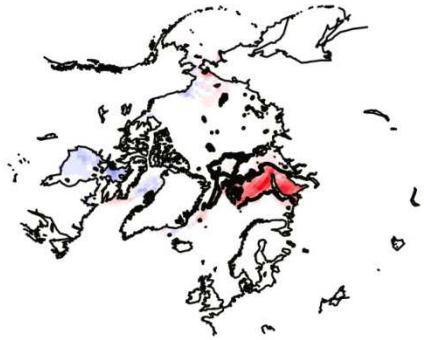
but the lead-time is longer than the expected atmospheric response time to SIC forcing

- detrended, monthly anomalies;
period 1979-2013;
target – cold season (Sep-to-Feb)

HadISST

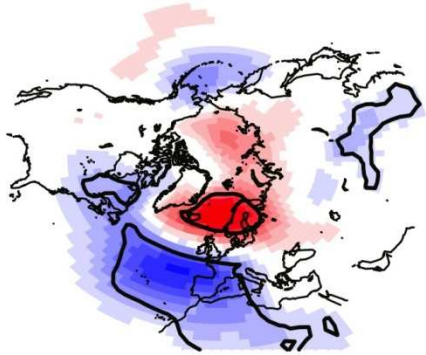


a) **MCA-SIC/eG$_{NOV}$ x SIC (nov)**



sig.lev.(SC)=6%

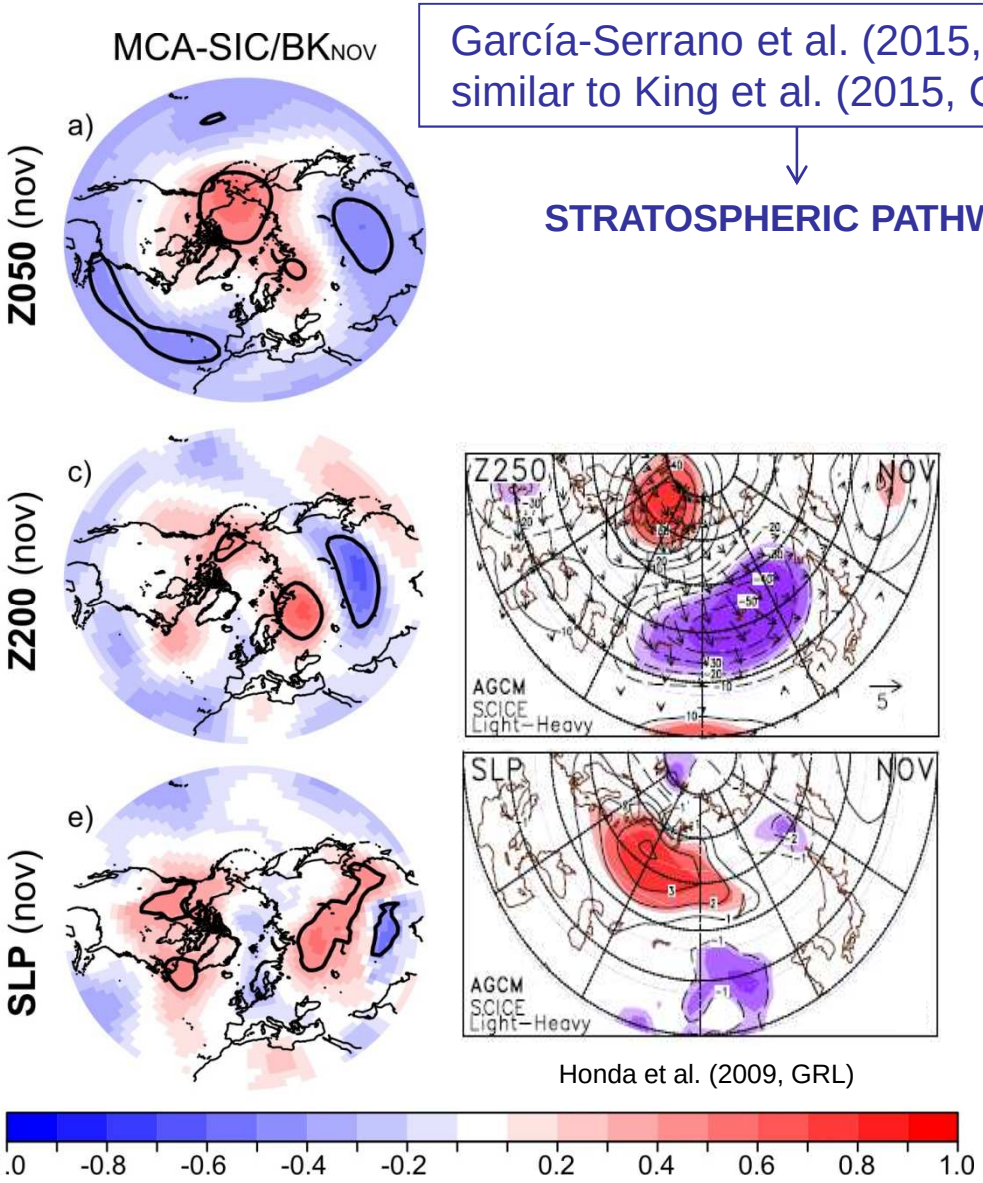
b) **MCA-SIC/eG$_{NOV}$ x SLP (jan)**



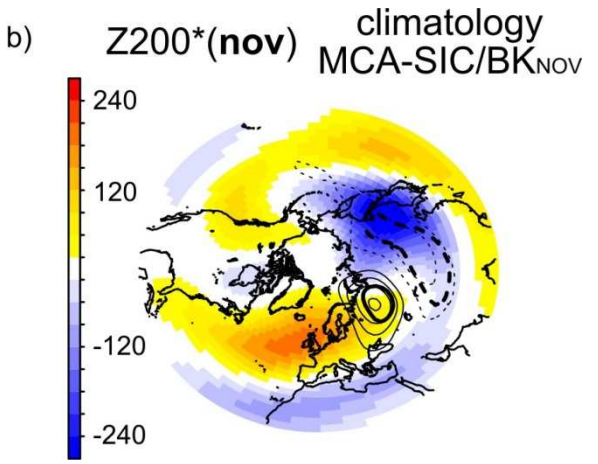
- detrended, monthly anomalies;
period 1979-2013;
target – cold season (Sep-to-Feb)

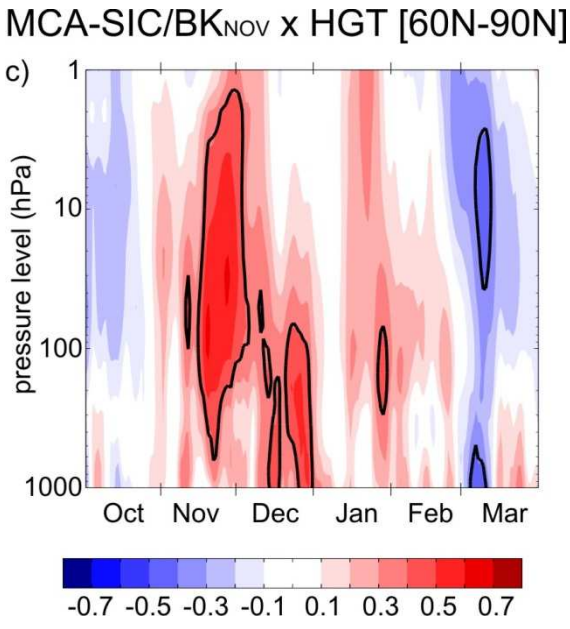
García-Serrano et al. (2015, JCLIM); similar to King et al. (2015, ClimDyn)

STRATOSPHERIC PATHWAY



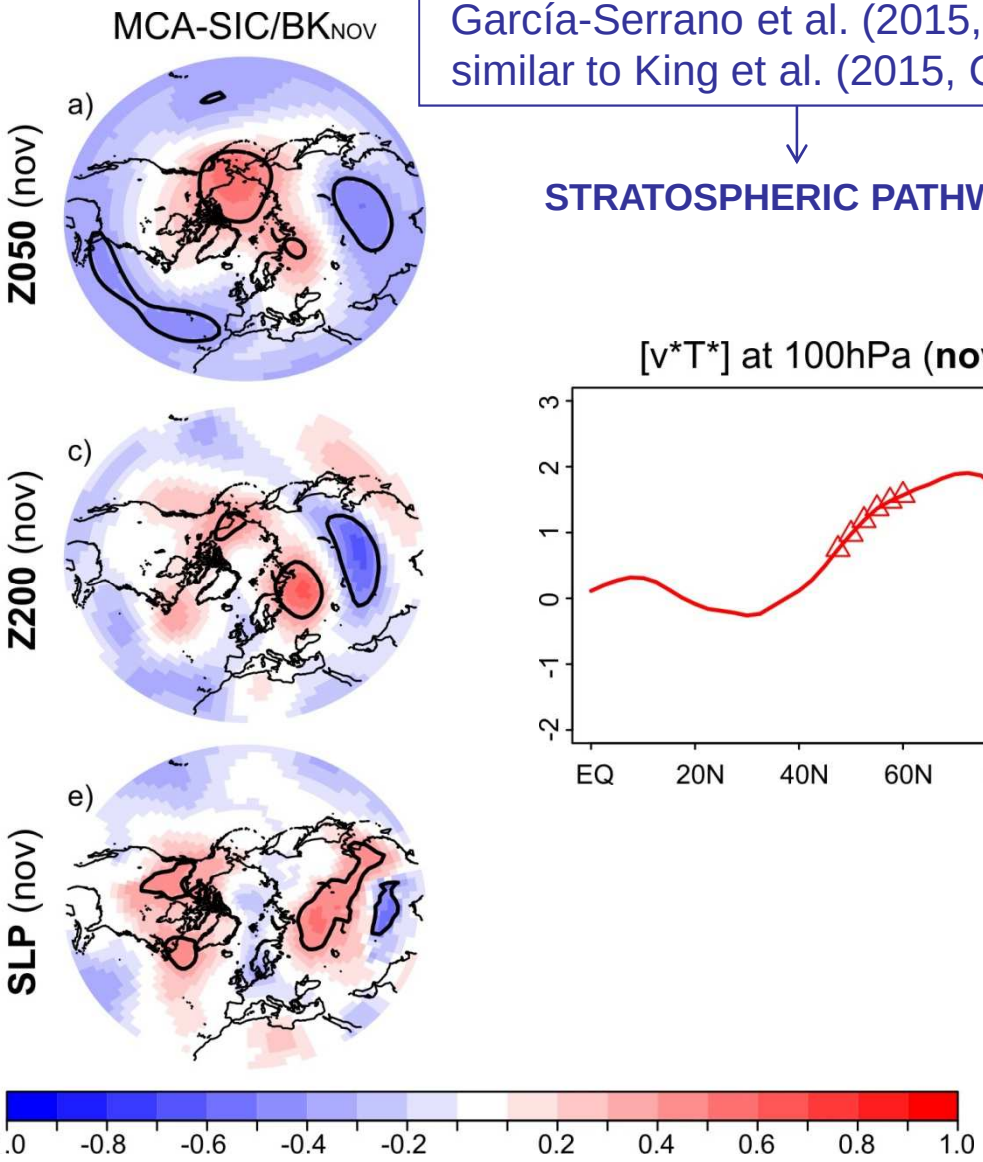
Honda et al. (2009, GRL)

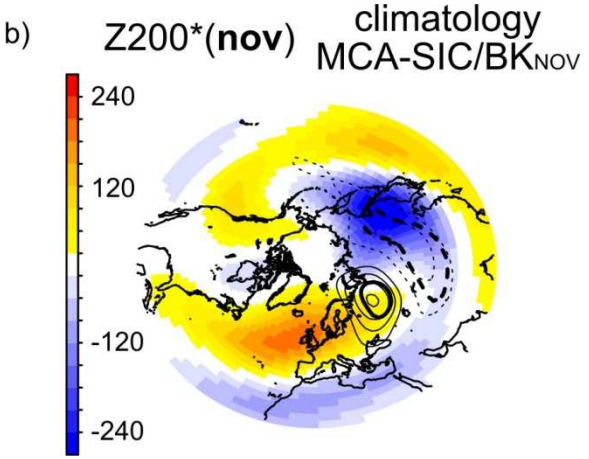


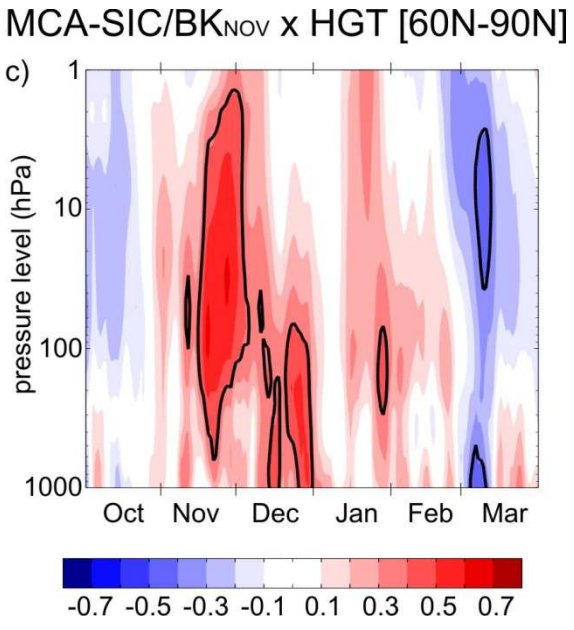


García-Serrano et al. (2015, JCLIM); similar to King et al. (2015, ClimDyn)

STRATOSPHERIC PATHWAY



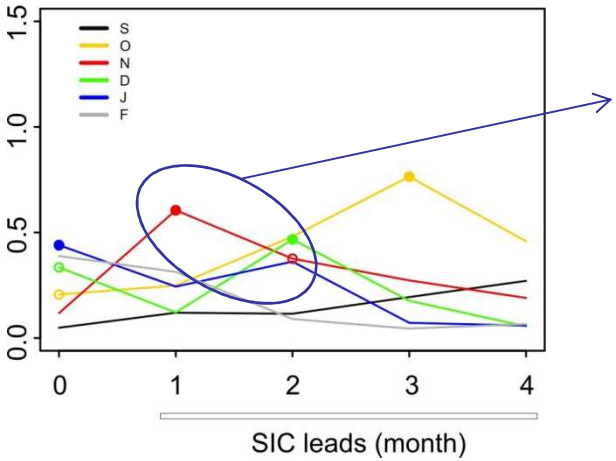




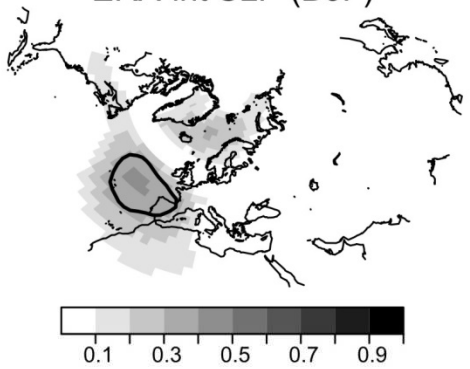
HadISST

predicted by **SIC/BK**$_{Nov}$

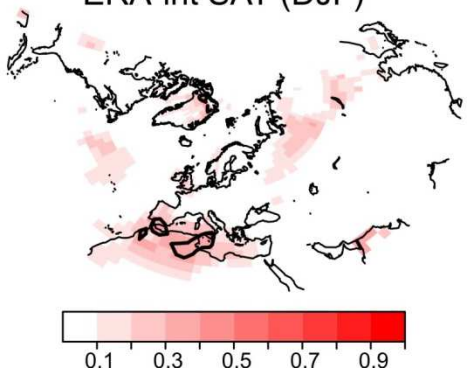
SC / east of Greenland (eG)



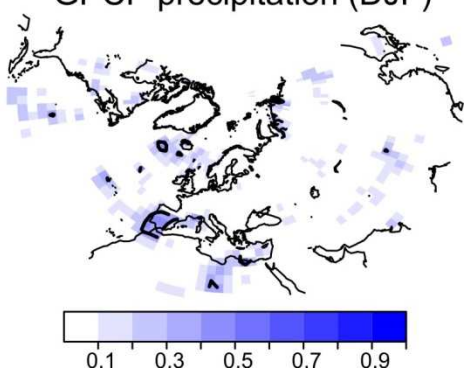
ERA-int SLP (DJF)



ERA-int SAT (DJF)



GPCP precipitation (DJF)

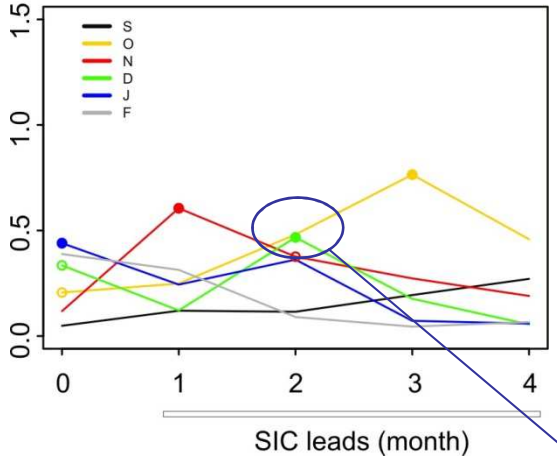


- detrended, monthly anomalies;
period 1979-2013;
target – cold season (Sep-to-Feb)

García-Serrano et al. (2015, JCLIM); in agreement with Scaife et al. (2014, GRL) and Koenigk et al. (2015, ClimDyn)

HadISST

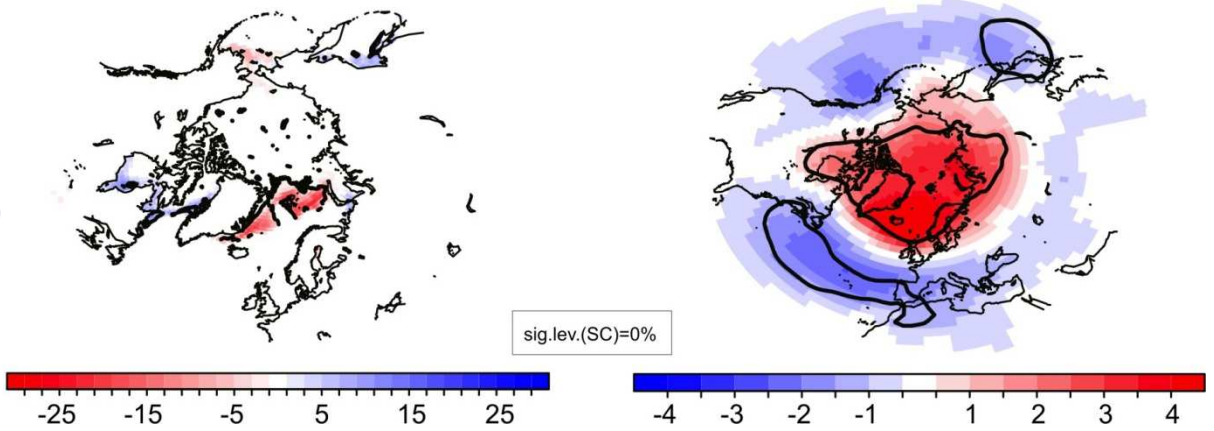
SC / east of Greenland (eG)

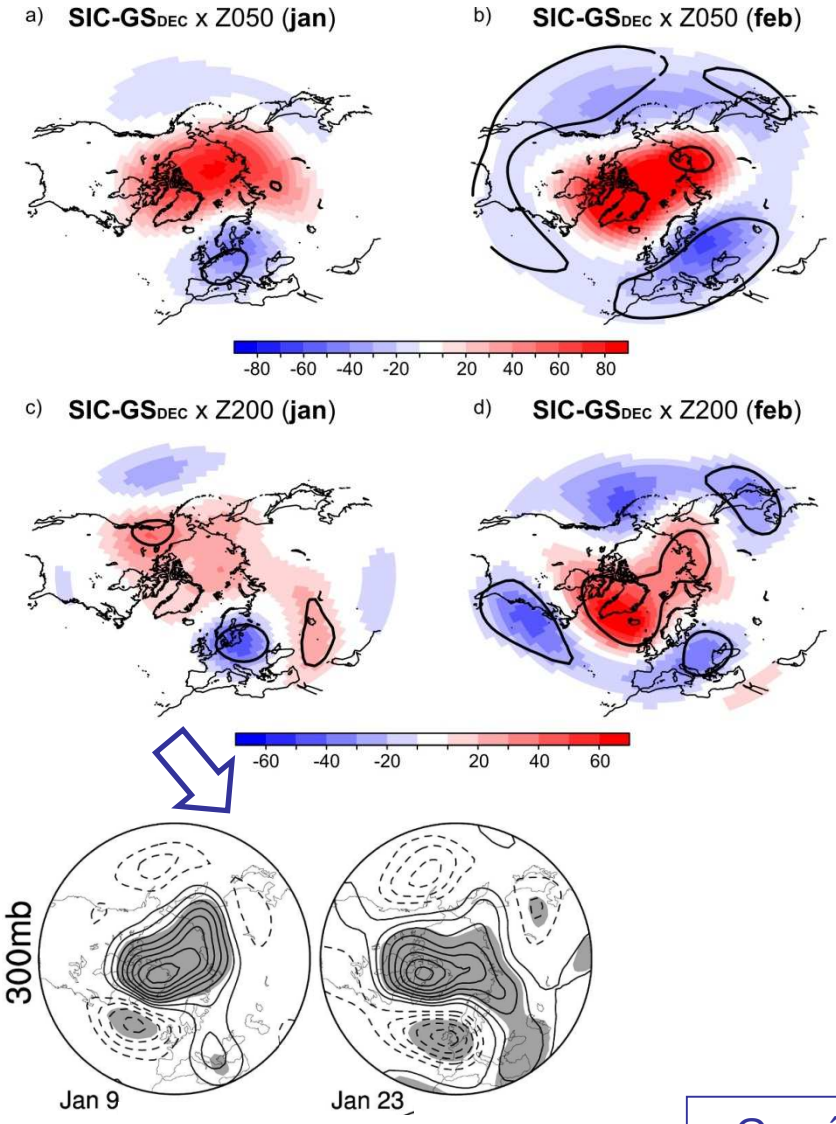


- detrended, monthly anomalies;
period 1979-2013;
target – cold season (Sep-to-Feb)

c) **MCA-SIC/eG$_{DEC}$** x SIC (**dec**)

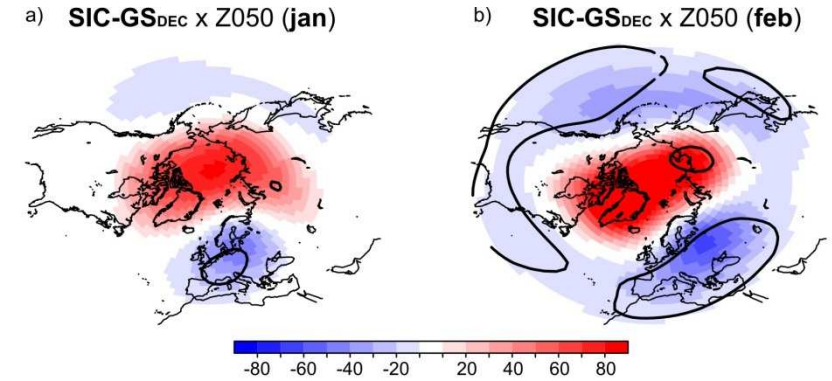
d) **MCA-SIC/eG$_{DEC}$** x SLP (**feb**)

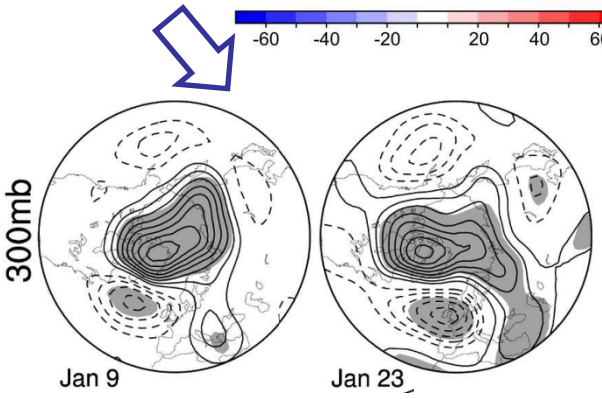




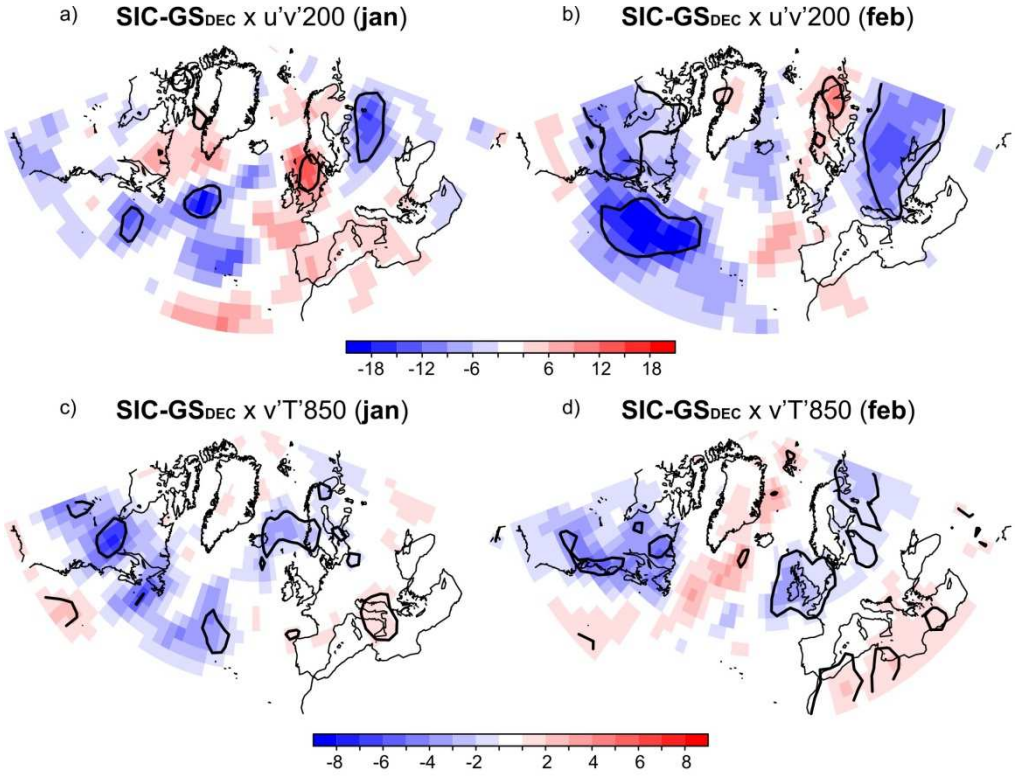
Deser et al. (2007, JCLIM)

García-Serrano and Frankignoul (2015, ClimDyn)





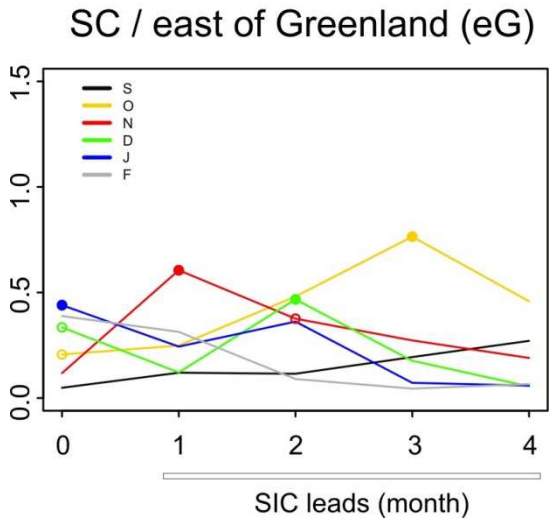
Deser et al. (2007, JCLIM)



TROPOSPHERIC DYNAMICS

García-Serrano and Frankignoul (2015, ClimDyn)

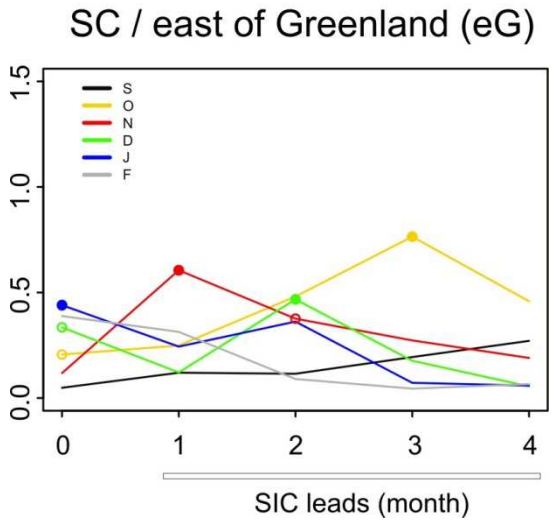
HadISST

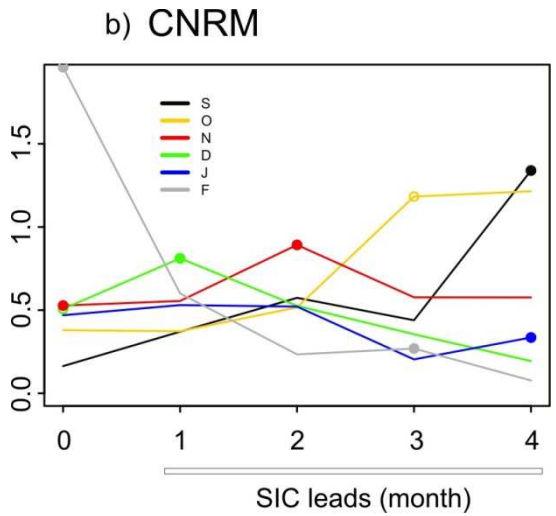


- detrended, monthly anomalies;
period 1979-2013;
target – cold season (Sep-to-Feb)

- **CMIP5**: no multi-model, each model individually;
CCSM4 (5mb), CNRM-CM5 (10mb), EC-EARTH2.3 (3mb), GFDL-CM2.1 (10mb), HadGEM2-ES (4mb), IPSL-CM5A-LR (3mb), MPI-ESM-MR (3mb), NorESM1-M (3mb) - HISTORICAL+RCP4.5 RUNS

HadISST





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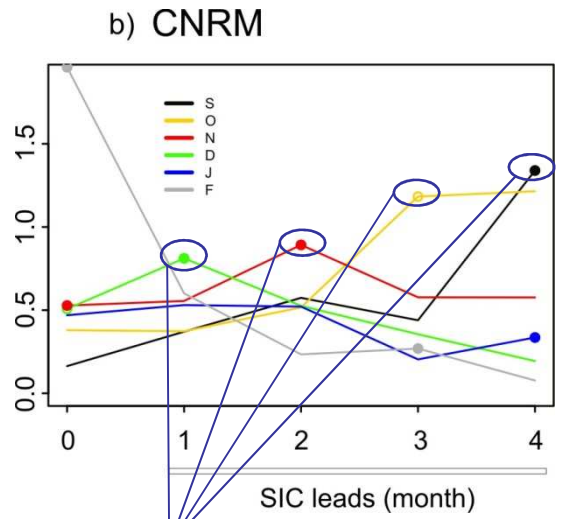
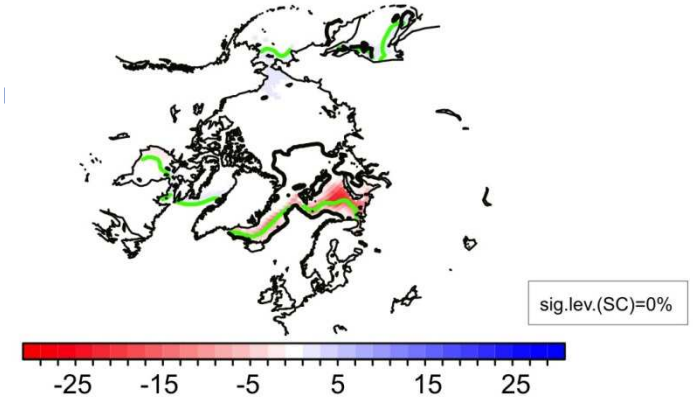


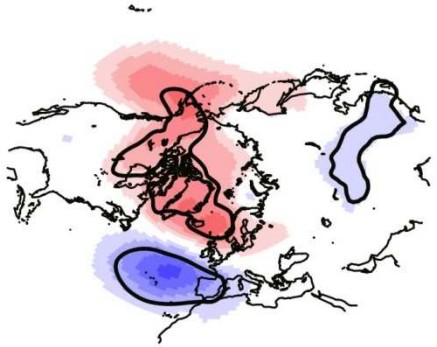
SIC persistence from Sep to Dec; sig. influence on the atm. – Jan

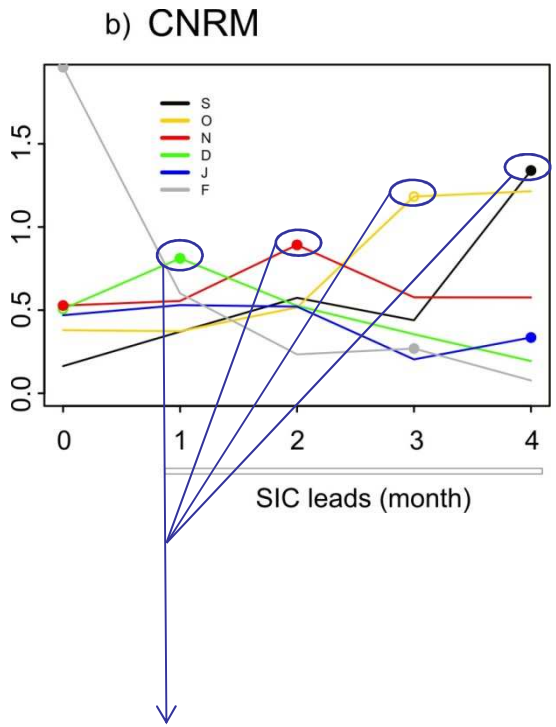
CNRM

a) **MCA-SIC/eA$_{DEC}$** x SIC (**dec**)



b) **MCA-SIC/eA$_{DEC}$** x SLP (**jan**)





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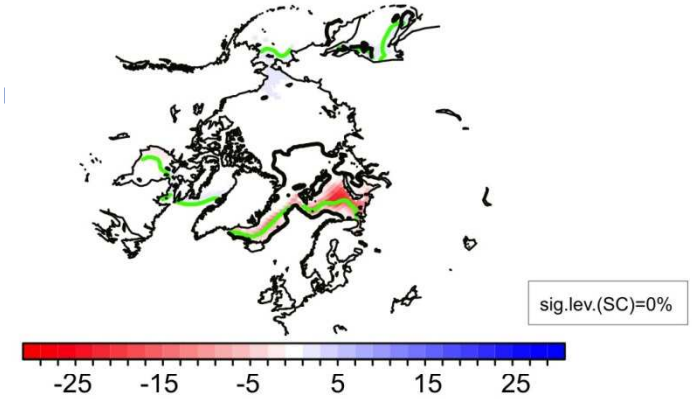
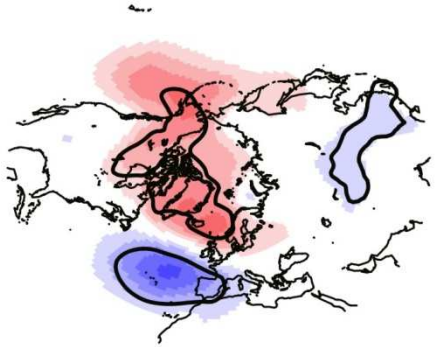
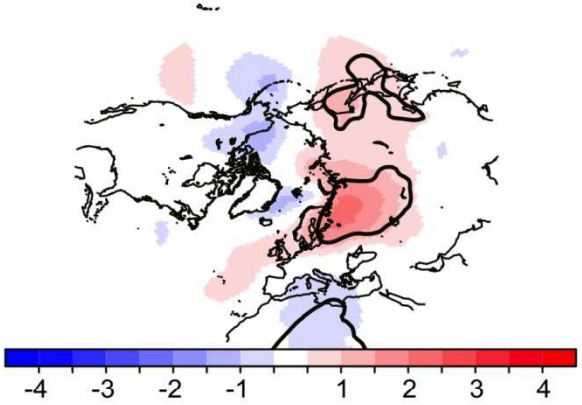


b) **MCA-SIC/eA$_{DEC}$** x SLP (**jan**)

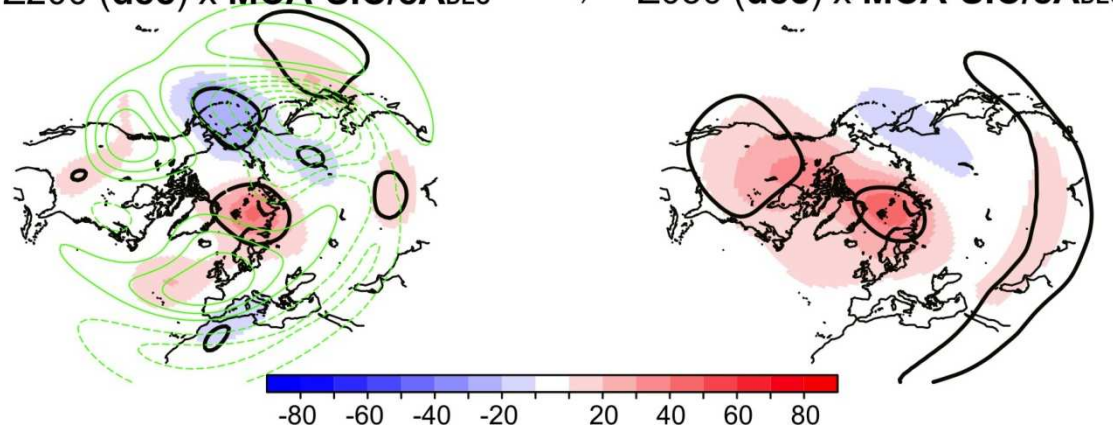


c) SLP (**dec**) x **MCA-SIC/eA$_{DEC}$**

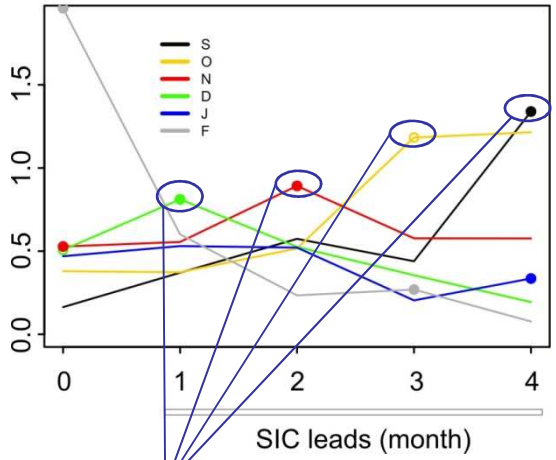


e) Z200 (**dec**) x **MCA-SIC/eA$_{DEC}$**

f) Z050 (**dec**) x **MCA-SIC/eA$_{DEC}$**



b) CNRM



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CNRM

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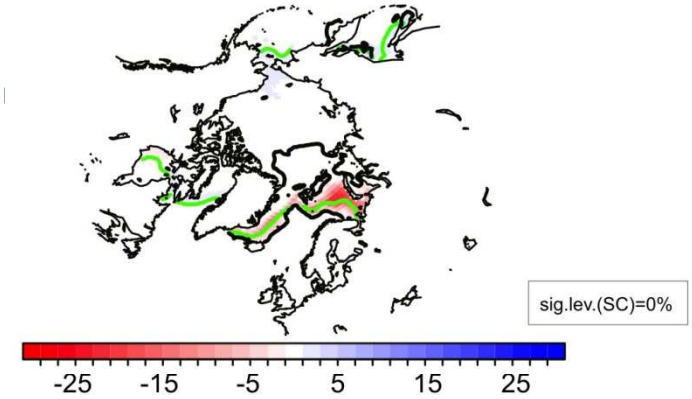
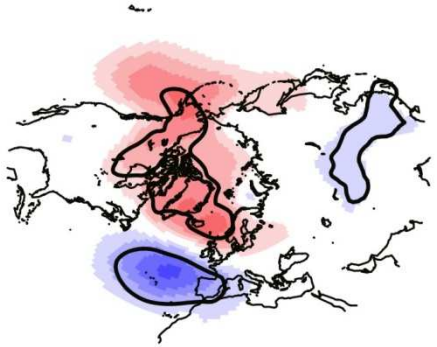
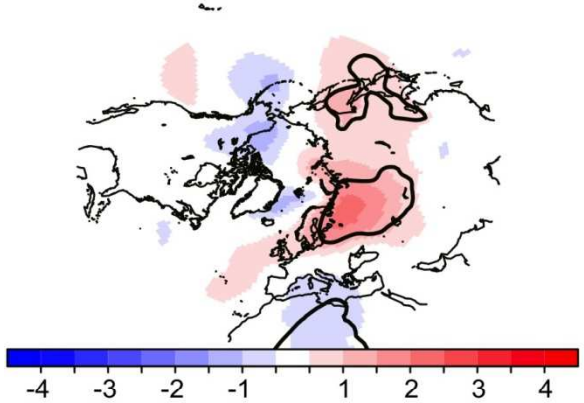


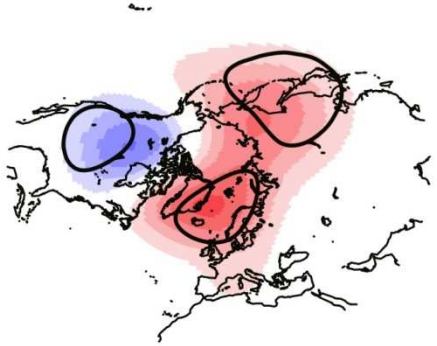
b) **MCA-SIC/eA$_{DEC}$** x SLP (**jan**)



c) SLP (**dec**) x **MCA-SIC/eA$_{DEC}$**

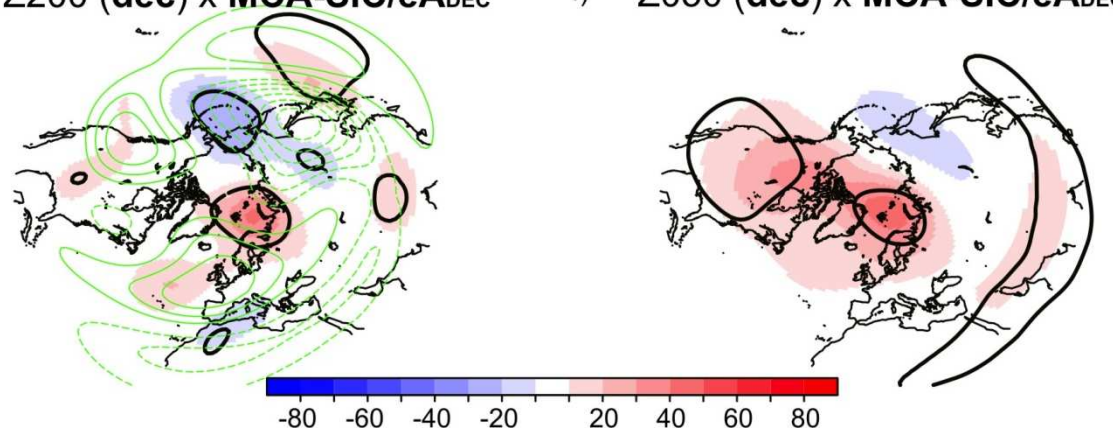


d) Z050 (**jan**) x **MCA-SIC/eA$_{DEC}$**

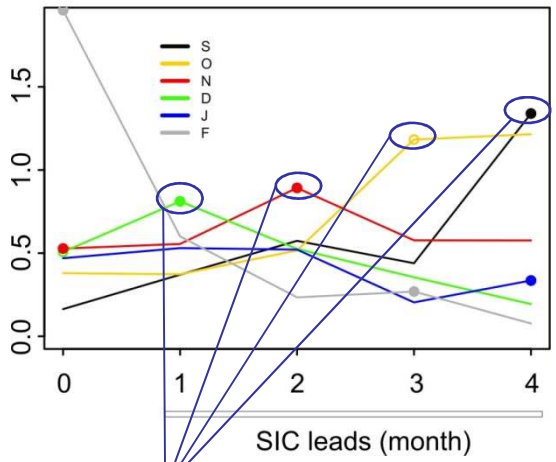


e) Z200 (**dec**) x **MCA-SIC/eA$_{DEC}$**

f) Z050 (**dec**) x **MCA-SIC/eA$_{DEC}$**



b) CNRM



SIC persistence from Sep to Dec;
sig. influence on the atm. – Jan

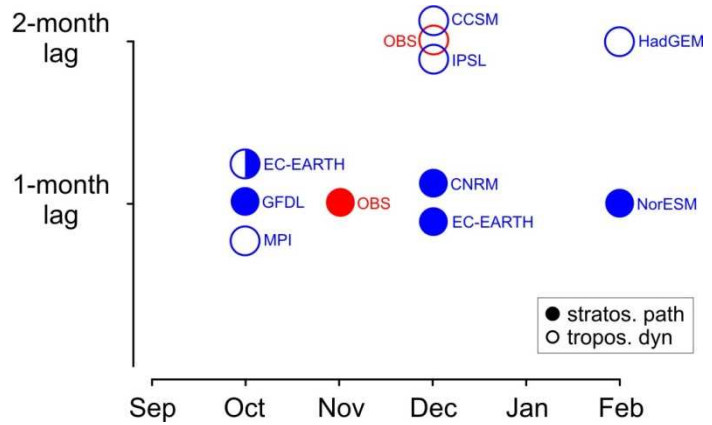
SUMMARY

- CMIP5 models analysed here show a significant link with sea-ice reduction over the eastern Arctic (Greenland-Barents-Kara Seas) followed by a negative NAO-like pattern

- If the simulated relationship takes *one month* – the results suggest (in general) that a stratospheric pathway could be at play [in observations, this is shown for SIC in Nov]

- If the simulated relationship takes *two months* – the results suggest (in general) that tropospheric dynamics are dominant [in observations, this is shown for SIC in Dec]

- Target experiments are needed to gain insight into the role played by the background-flow



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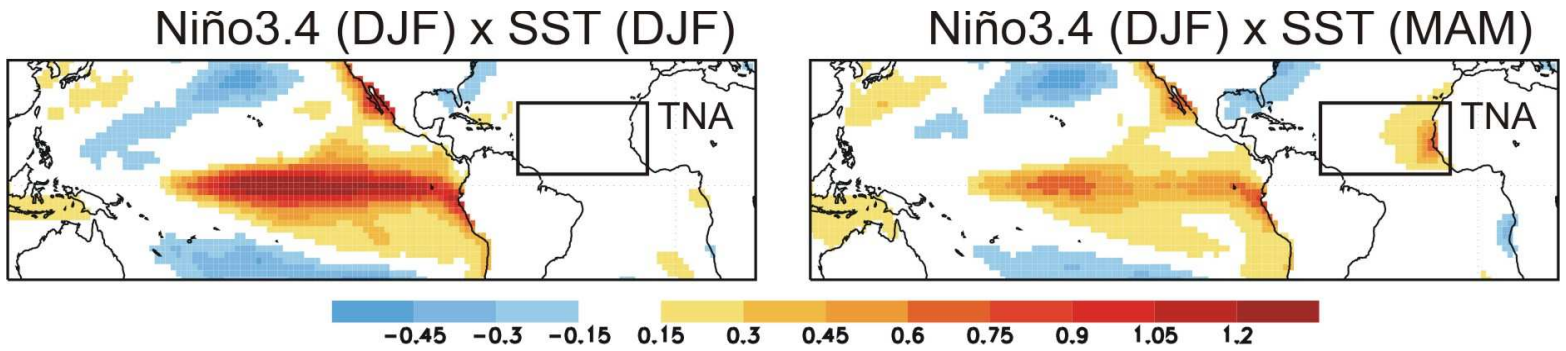
EXCELENCIA SEVERO OCHOA

H2020 MSCA-IF-EF "**DPETNA**"

Dynamics and **P**redictability of the **E**NSO teleconnection to the **T**ropical **N**orth **A**tlantic

fellow: J.García-Serrano / host (BSC-ES): F.J. Doblas-Reyes
secondments (3-month stays): CNRM/GAME + CERFACS

DPETNA



scientific objective: to advance understanding of the simulation and prediction of TNA SSTs at seasonal-to-interannual timescales

main goals:

(i) to gain insight into the dynamical mechanisms at work, evaluation of a new teleconnection mechanism for the timing of the inter-tropical relationship

(ii) to assess the ability of current seasonal forecast systems in representing the ENSO-TNA teleconnection, assessment of the ENSO contribution to SST skill over the TNA region

(iii) to explore the link between model systematic errors and the success/lack of SST skill over the TNA region (towards reducing bias-related uncertainties)

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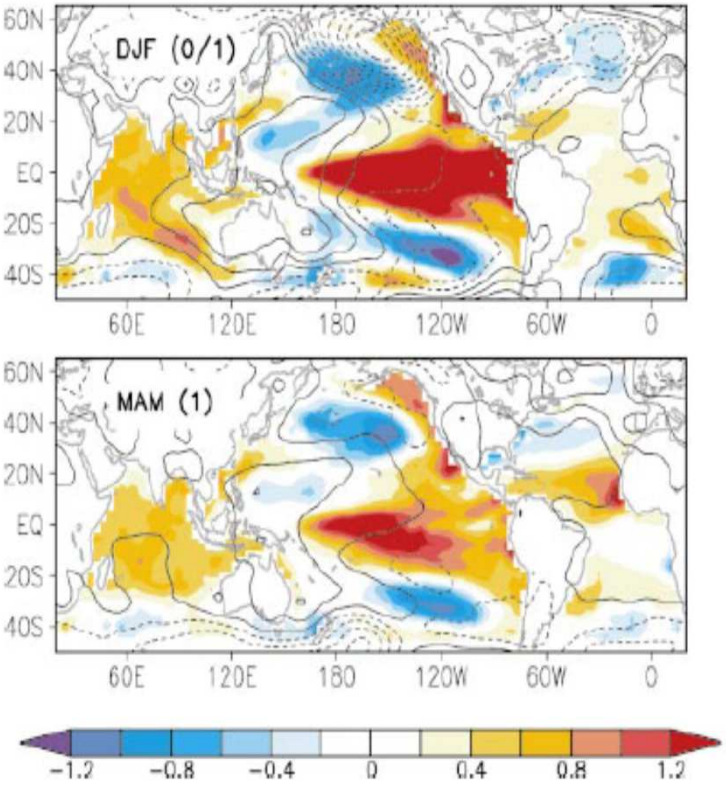
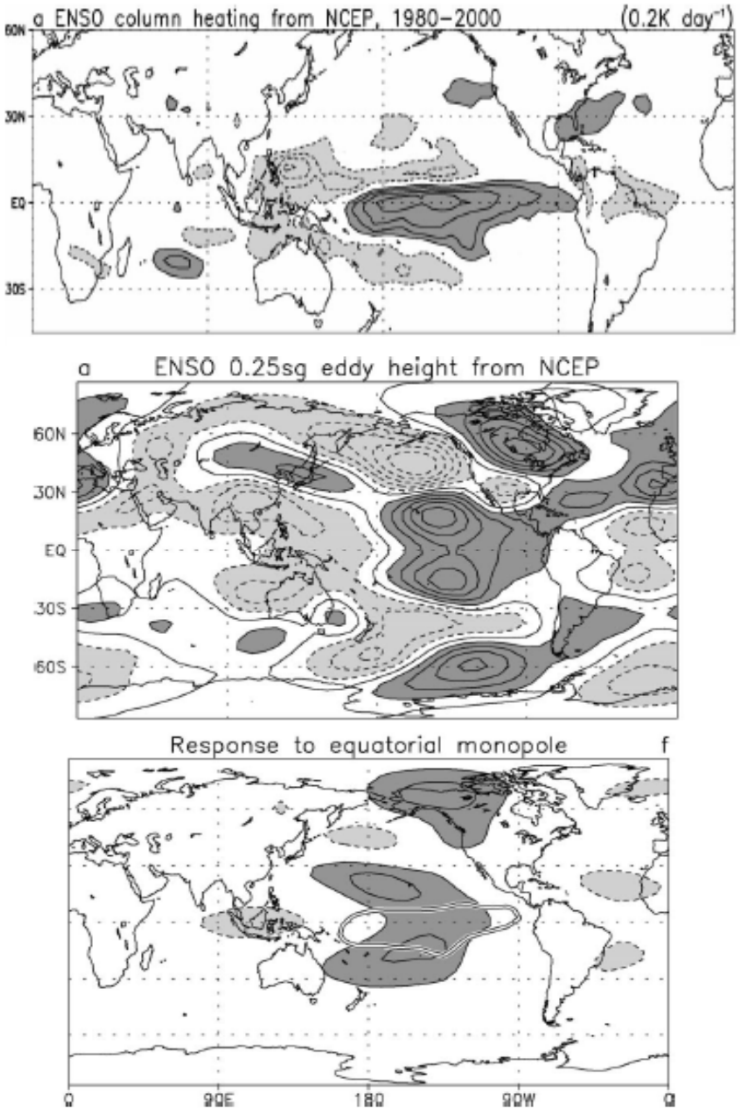


Alexander et al. (2002, JCLIM)



DeWeaver and Nigam et al. (2002, 2004 JCLIM)